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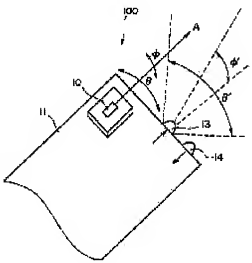
(71)Applicant : **FUJI XEROX CO LTD**
(72)Inventor : **SUGINO SO**
OTA TAKESHI
OKAWA YUTAKA

(54) INFRARED RAY COMMUNICATION EQUIPMENT

(57)Abstract:
PROBLEM TO BE SOLVED: To improve the degree of freedom of equipment installation by using an infrared ray signal transmitter-receiver whose optical axis direction is able to be deflected within a prescribed range so as to retrieve a direction in which reception strength is maximized.
SOLUTION: An infrared ray transmission reception unit 100 is made up of a 1st infrared ray signal transmitter-receiver 10 having a sharp directivity and 2nd infrared ray signal transmitter and receiver 13, 14 having a wide directivity. The 1st transmitter-receiver 10 is mounted on a frame driven by a motor so as to change its optical axis direction in a prescribed range in vertical and horizontal directions. The infrared ray transmission reception unit 100 is mounted respectively on a desk-top computer and a portable computer, between which infrared ray communication is executed. A transmitter side wide directivity signal transmitter 13 sends an ID signal. A receiver side receives the IS signal by a wide directivity signal receiver 14 and a wide directivity signal transmitter 13 sends an ID signal of the receiver side. Then the 1st signal transmitter-receiver 10 with a sharp directivity scans the directions of the received signal to search a direction in which the signal reception strength is maximized.



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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] The 1st infrared signal transmitter which turns an infrared signal in the predetermined direction of an optical axis, and transmits, The 1st infrared signal receiver which receives the infrared signal by which incidence is carried out from [said] an optical axis, and which the communications partner transmitted, The 2nd infrared signal transmitter which has directivity larger than the directivity of said 1st infrared signal transmitter, and transmits an infrared signal towards a predetermined communication region, The 2nd infrared signal receiver which receives the infrared signal by which has directivity larger than the directivity of said 1st infrared signal receiver, and incidence is carried out from the direction of the arbitration in said communication region, and which the communications partner transmitted, A direction modification means of an optical axis to change said direction of an optical axis, and by receiving the infrared signal which carries out incidence to said 1st infrared signal receiver while transmitting an infrared signal from said 1st infrared signal transmitter, making said direction of an optical axis change this -- the signal received with the 1st infrared signal receiver -- being based -- a communications partner -- The infrared communication device characterized by having the direction adjustment device of an optical axis which the communication direction which can communicate using said 1st infrared signal transmitter and said 1st infrared signal receiver is detected [adjustment device], and makes said direction of an optical axis turned in this communication direction.
[Claim 2] The infrared communication device according to claim 1 characterized by equipping said direction modification means of an optical axis with the stand of said 1st infrared signal transmitter, said 1st infrared signal receiver, said 2nd infrared signal transmitter, and said 2nd infrared signal receiver which holds said 1st infrared signal transmitter and said 1st infrared signal receiver at least, and a means to rotate this stand.
[Claim 3] The infrared communication device according to claim 1 characterized by equipping said direction modification means of an optical axis with the mirror which makes the optical axis of said 1st infrared signal transmitter and said 1st infrared signal receiver refracted, and a means to change the sense of this mirror.
[Claim 4] The infrared communication device according to claim 3 characterized by said mirror being what has the reflector of the spherical surface.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the infrared communication device which transmits and receives a signal using infrared radiation.
[0002]
[Description of the Prior Art] Conventionally, the infrared communication device transmit and receive a signal mutually using infrared radiation in two points which separated space, or among two or more points is used widely. Drawing 16 is drawing showing the situation of the infrared ray communication between a desktop computer and a luggable computer.
[0003] As shown in drawing 16 , in order to communicate with a desktop computer 70 and a luggable computer 71 mutually in between, the infrared signal transmitter and the receiver are built in in the device of these both sides, respectively, and a signal is mutually received so by using as a transmission medium infrared radiation r which spreads space. In such an infrared communication device, the installation direction and installation distance of a device receive constraint in many cases with the directivity of the light emitting device used for an infrared signal transmitter and a receiver, and the directivity of a photo detector.
[0004] Drawing 17 is an explanatory view about the directivity of the light emitting device of an infrared signal transmitter, and the directivity of the photo detector of an infrared signal receiver. As shown in drawing 17 , when outgoing radiation of the infrared 72a with directivity as shown by the continuous-line arrow head from the light emitting device 72 of the infrared signal transmitter with which one infrared communication device was equipped is carried out, the photo detector 73 of an infrared signal receiver with the directivity within the limits shown by broken-line 73a with which the infrared communication device of another side was equipped cannot receive the infrared signal transmitted from a light emitting device 72.
[0005]
[Problem(s) to be Solved by the Invention] So, in such an infrared communication device, there is a problem of having to adjust the installation direction of both communication devices and having to make in agreement the directivity of the light emitting device of an infrared signal transmitter and the directivity of the photo detector of an infrared signal receiver so that the luminescence direction of the light emitting device of a transmitter and the light-receiving direction of the photo detector of a receiver may be mutually in agreement of needing actuation troublesome for a user.
[0006] The technique to which the degree of freedom of the installation location of a transmitter and a receiver is made to increase is indicated by switching to a directive sharp Fresnel lens to arrange the optical element (for example, Fresnel lens) from which the directivity of light differs free [a change] in the front face of the light emitting device of an infrared transmitter as an approach of solving this problem at JP,5-145490,A, to switch to a directive large Fresnel lens to communicate with a large directive and unspecified partner, and perform a long distance communication link with a specific partner.

[0007] Moreover, the infrared transmitter equips an infrared transmitter with the infrared-emitting diode of extensive directivity, a narrow directivity infrared-emitting diode, and the change-over circuit that switches these, switches the directivity to it if needed, and it enabled it to transmit to it is indicated by JP,5-48470,U. Moreover, the infrared receiving set which enabled it to control the directive breadth of a receiver is indicated by JP,5-59989,A by carrying out parallel connection of two or more photo detectors to one set of a receiver.
[0008] However, the communicative dependability of each approach indicated by these official reports is low, since two or more carrier light emitting devices, optical system, and those switching units are needed, when there is a problem of being easy to become expensive, only a transmitter remains in amelioration of only a receiver and the solution about the infrared communication device which can respond to the both sides of the transmission and reception of extensive directivity in a communication partner's retrieval phase and the sharp directive transmission and reception in a communication phase is not offered.
[0009] In view of the above-mentioned situation, retrieval of the communication partner from the large range in a communication preparation phase and transmission and reception of the high-reliability in a communication phase and a high speed are possible, and this invention aims at offering an infrared communication device with the high degree of freedom of the installation location of a transceiver machine.
[0010]
[Means for Solving the Problem] The infrared communication device of this invention which attains the above-mentioned purpose The 1st infrared signal transmitter which turns an infrared signal in the predetermined direction of an optical axis, and transmits, The 1st infrared signal receiver which receives the infrared signal by which incidence is carried out from [above-mentioned] an optical axis, and which the communications partner transmitted, The 2nd infrared signal transmitter which has directivity larger than the directivity of the infrared signal transmitter of the above 1st, and transmits an infrared signal towards a predetermined communication region, The 2nd infrared signal receiver which receives the infrared signal by which has directivity larger than the directivity of the infrared signal receiver of the above 1st, and incidence is carried out from the direction of the arbitration in the above-mentioned communication region, and which the communications partner transmitted, A direction modification means of an optical axis to change the above-mentioned optical-axis direction, and by receiving the infrared signal which carries out incidence to the infrared signal receiver of the above 1st while transmitting an infrared signal from the infrared signal transmitter of the above 1st, making the above-mentioned optical-axis direction change Based on the signal received with the 1st infrared signal receiver, the communication direction which can communicate using the infrared signal transmitter of the above 1st with a communications partner and the infrared signal receiver of the above 1st is detected, and it is characterized by having the direction adjustment device of an optical axis which makes the above-mentioned optical-axis direction turned in the communication direction.
[0011] Here, the above-mentioned direction modification means of an optical axis may be equipped with the stand of the infrared signal transmitter of the above 1st, the infrared signal receiver of the above 1st, the infrared signal transmitter of the above 2nd, and the infrared signal receivers of the above 2nd which holds the infrared signal transmitter of the above 1st, and the infrared signal receiver of the above 1st at least, and a means to rotate the stand.
[0012] Moreover, the above-mentioned direction modification means of an optical axis may be equipped with the mirror which makes the optical axis of the infrared signal transmitter of the above 1st, and the infrared signal receiver of the above 1st refracted, and a means to change the sense of the mirror. Moreover, the above-mentioned mirror may have the reflector of the spherical surface.
[0013]
[Embodiment of the Invention] Hereafter, the operation gestalt of this invention is explained. Drawing 1 is the mimetic diagram showing the outline of the infrared transceiver unit in the 1st operation gestalt of the infrared communication device of this invention. As shown in drawing 1 , to this infrared transceiver unit 100 The 1st infrared signal transceiver machine 10 with the sharp directivity to the direction A of an

optical axis, The communication module 12 equipped with the direction modification device of an optical axis in which lay the 1st infrared signal transceiver machine 10, and the direction A of an optical axis is made to change into a horizontal direction theta and a perpendicular direction phi, Were attached in the substrate 11 which lays a communication module 12, and the substrate 11. It has the 2nd infrared signal receiver 14 which has the 2nd infrared signal transmitter 13 of extensive directivity and the same extensive directivity which have the breadth of include-angle theta' horizontally, and have the breadth of include-angle phi' perpendicularly. Although the 2nd infrared signal transmitter 13 and the 2nd infrared signal receiver 14 are being fixed to the substrate 11, theta' is the same as that of the horizontal modification include angle theta of the direction modification device of an optical axis with which the communication module 12 was equipped almost whenever [horizontal angle-of-divergence], and phi' is mostly set as the same include angle whenever [vertical angle-of-divergence] with the modification include angle phi of the perpendicular direction of the direction modification device of an optical axis with which the communication module 12 was equipped. Therefore, the service area include angle of the 1st infrared signal transceiver machine and the 2nd infrared signal transceiver machine is almost the same.

[0014] With the direction adjustment device of an optical axis which mentions later the infrared transceiver unit 100 shown in drawing 1 , it incorporates in the body of an infrared communication device, and an infrared communication device is constituted. the case where infrared ray communication is performed between a desktop computer 70 and a luggable computer 71 like drawing 16 -- a desktop computer 70 and a luggable computer 71 -- it is alike, respectively and the infrared transceiver unit 100 shown in drawing 1 is incorporated.

[0015] Drawing 2 is the block diagram of the 1st infrared signal transceiver machine used for the communication module of an infrared transceiver unit shown in drawing 1 . The hood 24 of the light emitting device 21 which carries out outgoing radiation of the infrared signal to this infrared signal transceiver machine 10 towards the direction A of an optical axis as shown in drawing 2 , the lens 22 which condenses the infrared signal by which outgoing radiation was carried out, the half mirror 23 for light-receiving, and the cylindrical shape for intercepting the unnecessary beam of light from the direction of [other than the direction A of an optical axis], and giving directivity to receiving light, and the photo detector 25 which receives the infrared signal which the communications partner transmitted are had.

[0016] As a light emitting device 21, the laser diode (LD) or light emitting diode (LED) in which a high-speed modulation is possible is used. When LD is used, a directive sharp powerful light beam can be obtained by using a lens 22 together. Although directivity spreads a little from the case where LD is used when LED is used, a light beam with high safety can be obtained to human being's eyes. A photodiode (PD) etc. is used as a photo detector 25.

[0017] After sharp directivity is given with a lens 22 and the infrared signal by which outgoing radiation was carried out from the light emitting device 21 passes a half mirror 23, outgoing radiation of it is carried out towards the direction A of an optical axis. On the other hand, the infrared signal by which incidence was carried out to the hood 24 from the infrared transmitter of a communications partner is led to a photo detector 25 with a half mirror 23. The 1st infrared signal transceiver machine 10 constituted as shown in drawing 2 has an advantage of being easy to make in agreement the transmit direction and receive direction of an infrared signal.

[0018] Drawing 3 is other examples of the block diagram of the 1st infrared signal transceiver machine used for the communication module of an infrared transceiver unit shown in drawing 1 . drawing 3 -- being shown -- as -- this -- infrared radiation -- a signal -- transmission and reception -- a vessel -- ten -- ' -- **** -- an optical axis -- a direction -- A -- turning -- infrared radiation -- a signal -- outgoing radiation -- carrying out -- a light emitting device -- 21 -- outgoing radiation -- carrying out -- having had -- infrared radiation -- a signal -- condensing -- a lens -- 22 -- an optical axis -- a direction -- A -- except -- a direction -- from -- being unnecessary -- a beam of light -- intercepting -- reception -- light -- directivity -- giving -- a sake -- being large-sized -- a cylindrical shape -- a hood -- 24 -- ' -- a communications partner -- having transmitted -- infrared radiation -- a signal -- receiving -- a photo

detector -- 25 -- having -- having -- **** . Since the half mirror is not prepared, and the infrared signal which carried out incidence to the hood 24 is led to the direct photo detector 25, compared with the 1st infrared signal transceiver machine 10 shown in drawing 1 , there is no loss of an infrared signal in 1st infrared signal transceiver machine 10' shown in drawing 3 . Moreover, the infrared signal by which outgoing radiation is carried out from a light emitting device 21 can also be transmitted without loss.
[0019] Next, the direction modification means of an optical axis in this operation gestalt is explained. Drawing 4 is the schematic diagram showing 1 operation gestalt of the direction modification means of an optical axis in the infrared communication device of this invention. As shown in drawing 4 , for this direction modification means of an optical axis The base frame 35 holding the up stand 31 and the up stand 31 holding the 1st infrared signal transceiver machine 10 and the 1st infrared signal transceiver machine 10, It has the motor 32 which rotates the up stand 31 in the direction of arrow-head theta, the gear 33 of the hemicycle which holds a base frame 35 and is rotated in the direction of arrow-head phi, a gear 33 and the meshing gear 36, and the motor 37 that drives a gear 36.
[0020] Thus, by rotating the motor 32 of the constituted direction modification means of an optical axis By being able to rotate the up stand 31 in the direction of arrow-head theta, and being able to change the direction A of an optical axis of the 1st infrared signal transceiver machine 10 in the direction of arrow-head theta, and driving a motor 37 A base frame 35 can be rotated in the direction of arrow-head phi, and the direction A of an optical axis of the 1st infrared signal transceiver machine 10 can be made to change in the direction of arrow-head phi. As a motor 32 and a motor 37, a stepping motor or a voice coil motor is used. When a stepping motor is used, control is easy and can constitute the direction modification means of an optical axis by which positioning accuracy is high. Moreover, when a voice coil motor is used, the possible direction modification means of an optical axis of high-speed operation can be constituted.
[0021] Drawing 5 is the schematic diagram showing other operation gestalten of the direction modification means of an optical axis in the infrared communication device of this invention. As shown in drawing 5 , for this direction modification means of an optical axis The mirror 42 which makes the direction A of an optical axis of the infrared signal by which outgoing radiation is carried out from the 1st infrared signal transceiver machine 10 and the 1st infrared signal transceiver machine 10 refracted, It has the motor 41 which changes the sense of a mirror 42 in the direction of arrow-head u, the mirror 44 which makes the infrared signal reflected from the mirror 42 refracted in the direction of arrow-head phi, and the motor 43 which changes the sense of a mirror 44 in the direction of arrow-head v. In the case of drawing 4 , and the thing, the 1st infrared signal transceiver machine 10 is being fixed to the communication module 12 (refer to drawing 1), and it has structure which only mirrors 42 and 44 drive. The optical axis of the infrared signal by which outgoing radiation is carried out in the direction of A from the 1st infrared signal transceiver machine 10 is shaken in the direction of arrow-head theta by the mirror 42 rotated with a motor 41. The optical axis of an infrared signal is further shaken in the direction of arrow-head phi by the mirror 44 rotated with a motor 43. The input signal by which incidence is carried out to the 1st infrared signal transceiver machine 10 follows a process contrary to the case of transmission. As mirrors 42 and 44 in this operation gestalt, what formed the metal on the glass plate, the thing which vapor-deposited aluminum to the polished metal plate or the polished plastic sheet are used. When the plastic sheet which vapor-deposited aluminum is used, a part for moving part can be lightweight-ized, and the load of the motors at the time of being high-speed operation can be mitigated.
[0022] In addition, the method which changes the direction of an optical axis by rotating the 1st infrared signal transceiver machine 10 the whole stand as shown in drawing 4 , And in addition to the method which changes the direction of an optical axis by rotating only a mirror as shown in drawing 5 both these -- the direction modification of an optical axis about the combination of theta, for example, the direction, may make a formula partially the method which rotates the infrared signal transceiver machine 10 the whole stand, and the direction modification of an optical axis in the direction of phi may be constituted as a method which rotates a mirror.
[0023] Next, the direction adjustment device of an optical axis in the infrared communication device of this invention is explained. The role of this direction adjustment device of an optical axis is making it

turn in the direction which the direction of a communication distant office was detected [direction] using the above-mentioned direction modification means of an optical axis, and had the direction of an optical axis of the infrared signal transceiver machine of the above 1st detected, and is performed to coincidence by the infrared communication device of the both sides which should communicate in advance of actual communication. With this operation gestalt, this direction adjustment actuation of an optical axis is performed in the communication link initiation procedure explained below.

[0024] Drawing 6 is the explanatory view of the transceiver situation of two infrared communication devices for explaining communication link initiation procedure, and drawing 7 is the flow chart showing the procedure of the communication link initiation procedure in this operation gestalt. The infrared transceiver units 50a and 50b included in each two infrared communication devices are shown in drawing 6 . To these infrared transceiver units 50a and 50b The communication modules 52a and 52b equipped with the direction modification means of an optical axis (refer to drawing 4) which it had on Substrates 51a and 51b, and substrate 51a and 51b, respectively, The 1st infrared signal transceiver machine attached in communication modules 52a and 52b (illustration abbreviation), It has the 2nd infrared signal receiver 54a and 54b which has the 2nd infrared signal transmitter 53a and 53b which has the large directivity attached in Substrates 51a and 51b, and large directivity. here -- being large -- directivity -- drawing 1 -- having explained -- the -- two -- infrared radiation -- a signal -- a transmitter -- 13 -- and -- the -- two -- infrared radiation -- a signal -- a receiver -- 14 -- having -- directivity -- namely, -- being horizontal -- an angle of divergence -- whenever -- theta -- ' -- and -- a perpendicular direction -- an angle of divergence -- whenever -- phi -- ' -- meaning . Moreover, the 1st infrared signal transceiver machine attached in communication modules 52a and 52b is constituted like the 1st infrared signal transceiver machine 10 shown in drawing 2 .

[0025] In addition, 2 sets of infrared transceiver units 50a and 50b shown in drawing 6 are some infrared communication devices built into peripheral devices, such as two or more desktop computers and luggable computers, and a printer. These computers and peripheral devices belong to one communication network, and the ID number for discriminating from other infrared communication devices is endowed with each infrared communication device built into these each computer and peripheral devices, respectively. Based on this ID number, a specific host (desktop computer) manages the communication link between each infrared communication device in a communication network.

[0026] Below, referring to drawing 7 , the procedure of communication link initiation procedure is divided into a transmitting side (step C) and a receiving side (step R), and is explained.

(Step C1) A communication link claim with a receiving side is performed to a host from the transmitting side which is going to start a communication link, and the authorization is obtained. ID signal which moreover put the receiving-side ID number and the transmitting-side ID number from infrared signal transmitter 53a of extensive directivity of infrared transceiver unit 50a of a transmitting side is sent out. If the coding method with which redundancy was added to this ID signal, for example, a block code, and a convolutional code are used, the ID number transmitted also when the signal strength of a receiving side was feeble can be recognized correctly.

[0027] (Step R1) In a receiving side, infrared signal receiver 54b of extensive directivity of infrared transceiver unit 50b receives the above-mentioned ID signal, and it judges whether received ID signal is an ID signal over a local station, and the ID number of a transmitting side is an ID number which is set up beforehand and by which communication link authorization was carried out. Processing is ended when the two above-mentioned conditions are not satisfied. When the two above-mentioned conditions are satisfied, it progresses to the following step.

[0028] (Step R2) While transmitting the ID number of a local station from infrared signal transmitter 53b of extensive directivity of a receiving side Were attached in communication-module 52b using the direction modification means of an optical axis of communication-module 52b of a receiving side. By scanning the direction A1 of an optical axis of the 1st infrared signal transceiver machine which has sharp directivity in the direction of theta, and the direction (referring to drawing 1) of phi, the direction where the receiving reinforcement of the signal sent from infrared signal transmitter 53a of extensive directivity of a transmitting side becomes max is detected. About the detail of the detection approach of

this communication direction, it mentions later.
[0029] (Step R3) As a result of the direction finding of step R2, if the direction of communication-module 52a is detected, it fixes in the direction A1 which had the direction of an optical axis of communication-module 52b detected, and an acknowledge signal is sent out from communication-module 52b.
(Step C2) If infrared signal receiver 54a of extensive directivity of a transmitting side receives the ID number of the receiving side transmitted from infrared signal transmitter 53b of a receiving side in step R2 Were attached in communication-module 52a using the direction modification means of an optical axis of communication-module 52a of a transmitting side. The direction A2 of an optical axis of the 1st infrared signal transceiver machine which has sharp directivity is scanned in the direction of theta, and the direction (refer to drawing 1) of phi, and the direction where the receiving reinforcement of ID signal sent from infrared signal transmitter 53b of a receiving side becomes max is detected.
[0030] (Step C3) As a result of the direction finding of step C2, if the direction of communication-module 53b is detected, it fixes in the direction A2 which had the direction of an optical axis of communication-module 52a detected, and an acknowledge signal is sent out from communication-module 52a.
(Step C4) Communication-module 52a of a transmitting side detects the acknowledge signal from communication-module 52b of a receiving side.
[0031] (Step R4) Communication-module 52b of a receiving side detects the acknowledge signal from communication-module 52a of a transmitting side.
If an acknowledge signal is detected by step C4 and step R4 by both the transmitting side and the receiving side, communication link initiation procedure will be ended. In addition, time-out time amount is set up for every above-mentioned step, when it cannot progress into predetermined time amount at the following step, communication link initiation procedure is stopped and a host is notified of that.
[0032] In the phase which this communication link initiation procedure ended, the directions A1 and A2 of an optical axis of the infrared transceiver unit of the communication module of both a transmitting side and a receiving side are completely in agreement, and will be in the condition in which communication by both infrared transceiver units 50a and 50b is possible. Since directivity large to the 1st infrared signal transmitter and receiver with which both infrared transceiver units 50a and 50b are equipped is not required, it has sharp directivity and can use an infrared transceiver machine with a long range. Therefore, when the distance between communication devices which can be communicated is prolonged, since it is hard to be influenced of an outpatient department signal, the infrared ray communication of high-reliability, a high SN ratio, and a high speed becomes possible.
[0033] Next, the detection approach of the communication direction is explained. Drawing 8 is the flow chart showing the procedure which detects the communication direction. Here, the location of the direction of theta of the direction A of an optical axis of a communication module 12 (refer to drawing 1) is set to S, the upper limit is set to Smax, a lower limit is set to Smin, the location of the direction of phi of the direction A of an optical axis is set to T, the upper limit is set to Tmax and a lower limit is set to Tmin.
[0034] First, the location T of the direction of phi of the direction A of an optical axis is initialized to a lower limit Tmin (step S1). Next, the location S of the direction of theta of the direction A of an optical axis is initialized to a lower limit Smin (step S2). Next, the reinforcement IX of the signal which the communication module received is measured, and measured value is memorized as a function X of S and T (S, T) (step S3).
[0035] Next, only the minute amount DS changes the direction A of an optical axis in the direction of theta (step S4). Next, if S is not S after changing the direction A of an optical axis over Smax as compared with Smax (step S5) as a result of the comparison, measurement of return and signal strength and storage of measured value are repeated to step S3. Namely, the direction A of an optical axis is scanned in the direction of theta.
[0036] As a result of a comparison at step S5, if S is over Smax, it will progress to step S6. Only the minute amount DT makes the direction A of an optical axis change in the direction of phi at step S6

(step S6). Next, if T is not T after making the direction A of an optical axis change over Tmax as compared with Tmax (step S7) as a result of the comparison, after initializing return and S to step S2 at a lower limit Smin, the actuation after step S3 is repeated. Namely, the direction A of an optical axis is scanned in the direction of phi.

[0037] If T is over Tmax as a result of the comparison at step S7, all scanning of the direction A of an optical axis will be completed. Thus, the profile of signal strength X (S, T) is obtained. Drawing 9 is a graph which shows the signal strength profile obtained by scanning the direction A of an optical axis in the direction of theta, and the direction of phi.

[0038] If Maximum Xp (Sp, Tp) is calculated out of this signal strength profile, the direction which becomes settled by that Sp and Tp will turn into the communication direction to search for. Actuation which detects the above-mentioned communication direction is performed using the direction equalization circuit of an optical axis as shown below. Drawing 10 is the block diagram of the direction equalization circuit of an optical axis which the communication direction is detected [equalization circuit] and makes the direction of an optical axis turned in the communication direction.

[0039] As shown in drawing 10 , this direction equalization circuit 60 of an optical axis The motor controller 61 which generates the control signal of the motor for the direction modification of an optical axis of the direction modification means of an optical axis, The amplifier 62 which amplifies the inputted input signal, and the filter 63 which removes an unnecessary signal component from the amplified signal, The AD (analog/digital) converter 64 which changes the filtered signal into a digital signal, RAM65 which stores the changed digital signal (Random access memory), It consists of ROM (Readonly memory)66 which stores the processing program based on the above-mentioned procedure (refer to drawing 6 and drawing 8), and MPU (microprocessing unit)67 which controls this whole direction adjusting device of an optical axis.

[0040] Next, actuation of this direction adjusting device of an optical axis is explained. Based on the processing program stored in ROM66, the motor controller 61 generates the direction driving signal of theta, and the direction driving signal of phi from MPU67 to the motor which drives the value of the location S of the direction of theta of the direction A of an optical axis, and the location T of the direction of phi in the motor and the direction of phi which drive the direction of an optical axis of reception and a communication module in the direction of theta, respectively. The direction of an optical axis of a communication module is controlled by these driving signals, it is received by the communication module and the input signal from [which was controlled] an optical axis is inputted into amplifier 62. It is amplified with amplifier 62, an unnecessary signal component is removed with a filter 63, digital conversion is carried out by the AD converter, and an input signal is contained by RAM65. In this way, the communication direction is searched for as mentioned above from the obtained signal strength profile.

[0041] In addition, although receiving signal strength is searching for the direction of an optical axis which shows maximum with the above-mentioned operation gestalt, making the direction of an optical axis change using the 1st infrared signal receiver which has sharp directivity This invention is not necessarily that to which receiving signal strength makes it indispensable requirements to search for the direction of an optical axis which shows maximum. For example, during scanning of the direction of an optical axis to the direction of theta or the direction of phi in drawing 8 When sufficiently the signal strength that can communicate using the 1st infrared signal transceiver machine is obtained, scanning is stopped there, the direction of an optical axis at that time is fixed as a communication direction, and you may make it start the 1st communication between infrared signal transceiver machines. When it does in this way, like the above-mentioned operation gestalt, it becomes unnecessary to measure receiving signal strength about the omnidirection which can scan, and the duration of a communication link access procedure can be shortened.

[0042] Next, by arranging the infrared reflector made to reflect an infrared signal among two or more infrared communication devices explains the approach to which the degree of freedom of the installation of an infrared communication device is made to increase. Drawing 11 is drawing showing the condition of having arranged the infrared reflector among two or more infrared communication devices.

[0043] As shown in drawing 11 , this infrared reflector 74 has the reflector of the spherical surface, is arranged between the desktop computers 70 and luggable computers 71 with which the infrared communication device of this invention was incorporated, respectively, and achieves the function which makes in agreement the direction of an optical axis of both infrared signal transceiver machines. Drawing 12 is drawing explaining the situation of reflection of the infrared signal by the infrared spherical-surface-type reflector.

[0044] As shown in drawing 12 , only infrared signal 72b by which outgoing radiation was carried out in the direction by which **** limitation was carried out among infrared signal 72a emitted from a light emitting device 72 reaches a photo detector 73. Therefore, in the conventional infrared communication device, since communication link effectiveness will fall and a communication range will become short if the infrared spherical-surface-type reflector 74 is used, it is not practical. However, in the infrared communication device of this invention, since sharp directivity can be given to the 1st infrared signal transceiver machine used in a communication phase and the direction of an optical axis can be controlled with high precision, reduction of the communication range by reflection can be made small. Moreover, since greater importance is attached than to the die length of a communication range to a directive size, the degree of freedom of arrangement of a light emitting device 72 and a photo detector 73 can be made to increase by using the infrared spherical-surface-type reflector which has the property reflected in the large direction like drawing 12 in the phase of detecting the direction of a communication partner with the 2nd infrared signal transceiver machine, when an infrared spherical-surface-type reflector is used.

[0045] Drawing 13 is an example of the detail drawing of an infrared spherical-surface-type reflector. the solid sphere in which this infrared reflector reflects infrared radiation as shown in drawing 13 -- it consists of 75, the plinth 76 holding this, and the dome-like covering 77. the thing which made it hard to perform nickel plating on the surface of a shot, and to raise an infrared reflection factor as solid sphere 75, and to rust -- a material -- carrying out -- this -- grinding -- carrying out -- a flat surface circular to the part -- making -- the core -- the female screw hole 78 -- opening -- a male screw 79 -- a solid sphere -- 75 is fixed to a plinth 76.

[0046] Endurance can be raised, when often reflecting infrared radiation even if it does not perform plating processing if the ingredient of solid sphere 75 is used as stainless steel. moreover, a solid sphere -- if the ingredient of 75 is made into brass, it can be made easy to process it. moreover, a solid sphere -- endurance can also be raised, when becoming lightweight that it is easy to process it and often reflecting infrared radiation after polish moreover, if the ingredient of 75 is made into aluminum. moreover, a solid sphere -- a reflector can be lightweight-ized if the aluminum vacuum evaporationo of the front face of Perilla frutescens (L.) Britton var. crispa (Thunb.) Decne. is carried out for the ingredient of 75 to resin. By performing coating which a visible ray is intercepted [coating] to the inside of a dome-like vitreous humour, and makes it penetrate infrared radiation as an ingredient of covering 77, reflective effectiveness improves and it is effective in removal of a foreign visible-ray noise. Moreover, an infrared reflector can be lightweight-ized if the acrylic resin which mixed the coloring matter which absorbs a visible ray as an ingredient of covering 77 is used. In addition, the ABS plastics which mixed the coloring matter which absorbs the light in respect of reinforcement are more advantageous.

[0047] Drawing 14 is drawing showing other examples of an infrared reflector. As shown in drawing 14 , this infrared reflector is constituted as a reflecting plate 83 with which it distributed in resin 82 and the corpuscle 81 of a large number with a diameter of 0.1mm - about 3mm was confined. It is reflected on many corpuscle 81 front faces on a reflecting plate 83, and the infrared radiation r by which outgoing radiation was carried out from the light emitting device 72 reaches a photo detector 73. The thing to which the corpuscle 81 vapor-deposited aluminum on the front face of acrylic resin or a glass bead, or an aluminum corpuscle is used. As resin 82, the resin of transparence or the resin which mixed the coloring matter which a visible ray is absorbed [coloring matter] and makes infrared radiation penetrate is used. If the resin which mixed the latter coloring matter is used, mixing of a foreign visible-ray noise can be prevented in the case of a communication link. If acrylic resin is used as an ingredient of resin 82, reflective effectiveness can be enlarged, and if ABS plastics are used, the infrared reflector of high

intensity is producible. Moreover, since this infrared reflector has not carried out the special configuration, it can be made to make it serve a double purpose as a panel for an ornament of a wall surface etc. Moreover, since it can miniaturize, a cellular phone is also easy.

[0048] Drawing 15 is drawing showing the example of further others of an infrared reflector. As shown in drawing 15 , this infrared reflector forms much spherical-surface-like projections 85 in a front face by performing press working of sheet metal to the thin metal plate 84. As a metal plate 84, the often ground stainless plate excels other metals in the point of reflective effectiveness and endurance. This infrared reflector fits mass production method, and can be manufactured cheaply.

[0049]

[Effect of the Invention] The infrared signal transceiver machine which has large directivity according to the infrared communication device of this invention as explained above, A direction modification means of an optical axis to change the direction of an optical axis of the infrared signal transceiver machine which has sharp directivity, and the infrared signal transceiver machine which has sharp directivity, In the phase of looking for a communication partner by having combined the direction adjustment device of an optical axis made being turned in the direction which the direction of a communication partner's infrared communication device was detected [direction], and had the above-mentioned optical-axis direction detected The infrared signal which can look for a communication partner out of a large service area, and has sharp directivity in an actual communication phase can perform infrared ray communication of high-reliability and a high speed.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the mimetic diagram showing the outline of the infrared transceiver unit in the 1st operation gestalt of the infrared communication device of this invention.
[Drawing 2] It is the block diagram of the 1st infrared signal transceiver machine used for the communication module of an infrared transceiver unit shown in drawing 1 .
[Drawing 3] They are other examples of the block diagram of the 1st infrared signal transceiver machine used for the communication module of an infrared transceiver unit shown in drawing 1 .
[Drawing 4] It is the schematic diagram showing 1 operation gestalt of the direction modification means of an optical axis in the infrared communication device of this invention.
[Drawing 5] It is the schematic diagram showing other operation gestalten of the direction modification means of an optical axis in the infrared communication device of this invention.
[Drawing 6] It is the explanatory view of the transceiver situation of two infrared communication devices for explaining communication link initiation procedure.
[Drawing 7] It is the flow chart showing the procedure of the communication link initiation procedure in this operation gestalt.
[Drawing 8] It is the flow chart showing the procedure which detects the communication direction.
[Drawing 9] It is the graph which shows the signal strength profile obtained by scanning the direction A of an optical axis in the direction of theta, and the direction of phi.
[Drawing 10] It is the block diagram of the direction equalization circuit of an optical axis which the communication direction is detected [equalization circuit] and makes the direction of an optical axis turned in the communication direction.
[Drawing 11] It is drawing showing the condition of having arranged the infrared reflector among two or more infrared communication devices.
[Drawing 12] It is drawing explaining the situation of reflection of the infrared signal by the infrared spherical-surface-type reflector.
[Drawing 13] It is an example of the detail drawing of an infrared spherical-surface-type reflector.
[Drawing 14] It is drawing showing other examples of an infrared reflector.
[Drawing 15] It is drawing showing the example of further others of an infrared reflector.
[Drawing 16] It is drawing showing the situation of the infrared ray communication between a desktop computer and a luggable computer.
[Drawing 17] It is an explanatory view about the directivity of the light emitting device of an infrared signal transmitter, and the directivity of the photo detector of an infrared signal receiver.
[Description of Notations]
10 1st Infrared Signal Transceiver Machine
11 Substrate
12 Communication Module
13 2nd Infrared Signal Transmitter
14 2nd Infrared Signal Receiver

21 Light Emitting Device
22 Lens
23 Half Mirror
24 Hood
25 Photo Detector
31 Up Stand
32 Motor
33 Gear
35 Base Frame
36 Gear
37 Motor
41 Motor
42 Mirror
43 Motor
44 Mirror
70 Desktop Computer
71 Luggable Computer
100 Infrared Transceiver Unit

[Translation done.]

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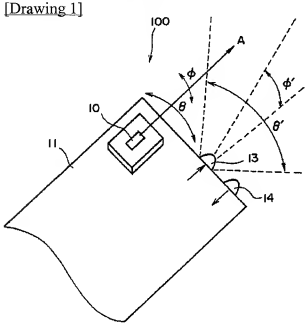
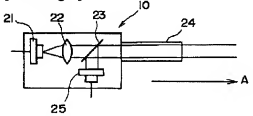
DRAWINGS

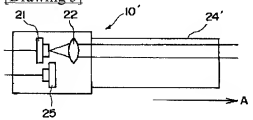
[Drawing 1]



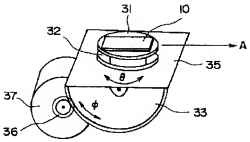
[Drawing 2]



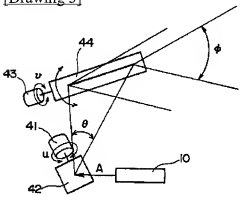
[Drawing 3]



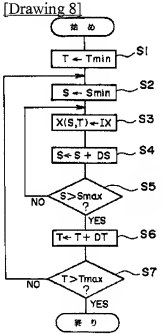
[Drawing 4]



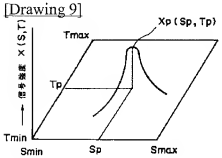
[Drawing 5]



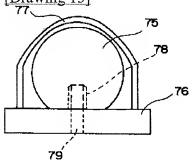
[Drawing 8]



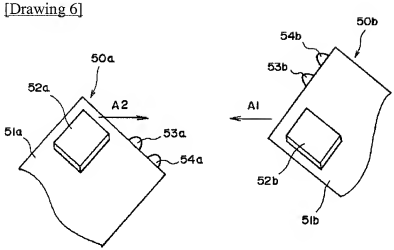
[Drawing 9]



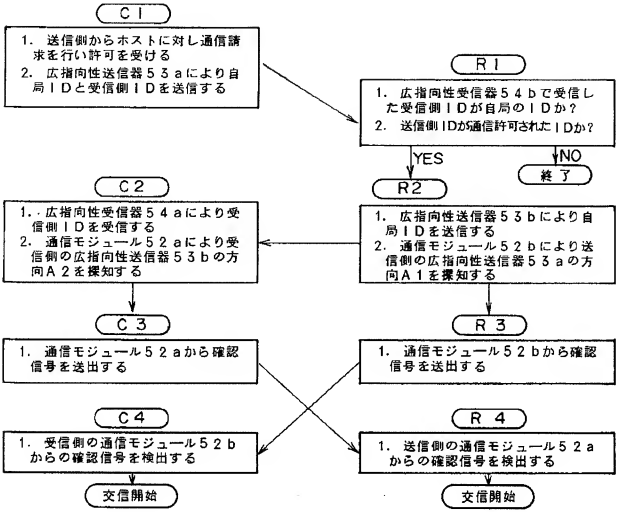
[Drawing 13]



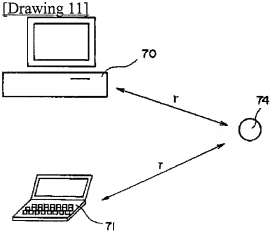
[Drawing 6]



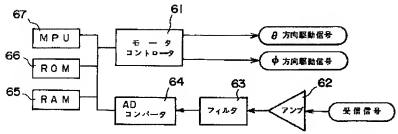
[Drawing 7]



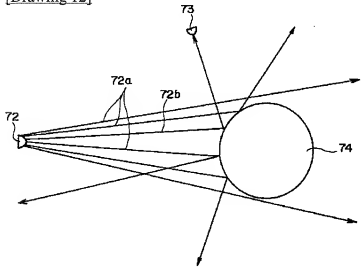
[Drawing 11]



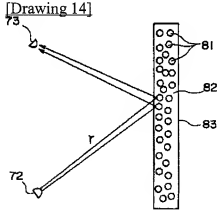
[Drawing 10]



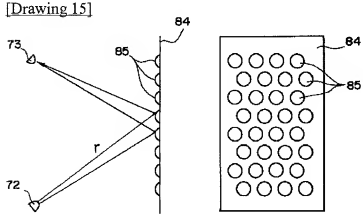
[Drawing 12]



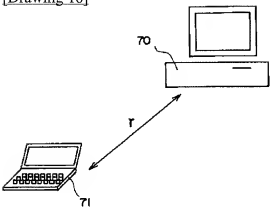
[Drawing 14]



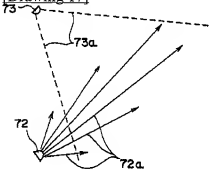
[Drawing 15]



[Drawing 16]



[Drawing 17]



[Translation done.]